

## Information Statistics II

### Lecture 13. Texture characterization by mathematical morphology

Texture is an image that is organized by a pattern of repeating or unrepeating texture primitives, which are small objects like grains. It is not the shape of large objects but shapes or density of grains that are meaningful in perception of textures. The pattern spectrum is a useful tool for texture analysis since it extracts size distribution of grains.

#### Texture characterization by pattern spectrum and optimization method (by Asano)

- This method finds a structuring element of a limited extent which fits the particle in the target texture best. Textures in natural scenes often contain particles of a shape at various sizes, since the shapes of particles depend on the materials of which the entities of textures are made. Assuming this, the spectral value of each size may be almost similar if the structuring element is similar to the particles in the target texture. Thus the shape of structuring element is optimized by the criterion of minimizing the variance of spectral values using the method of simulated annealing, and describe the shape of particles by the shape of the optimized structuring element.

#### References:

A. Asano, M. Miyagawa, and M. Fujio, "Texture Modelling by Optimal Gray Scale Structuring Elements using Morphological Pattern Spectrum," *Proc. 15th International Conference on Pattern Recognition (ICPR 2000)*, **3**, 479-482 (2000).

#### Texture segmentation by pattern spectrum (by Dougherty)

- Pattern spectra of segments in an image are calculated, and the segments are categorized by characteristics of the pattern spectra.

#### References:

E. R. Dougherty, J. T. Newell, and J. B. Pelz, "Morphological Texture-Based Maximum-Likelihood Pixel Classification Based on Local Gramulometric Moments," *Pattern Recognition*, **25**, 10, 1181-1198 (1992).

#### Texture categorization by optimization of structuring element (by Kotani)

- To categorize textures, the structuring element is optimized to obtain the best discrimination of the textures by the characteristics of pattern spectrum calculated with the optimized structuring element.

#### References:

S. Yamamoto and K. Kotani, Optimization of Structuring Element on Mathematical Morphology by GA and Its Application to Texture Analysis," *IEICE Technical Report of Computer Vision and Image Media*, **109**, 57-64 (1998) [in Japanese].

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